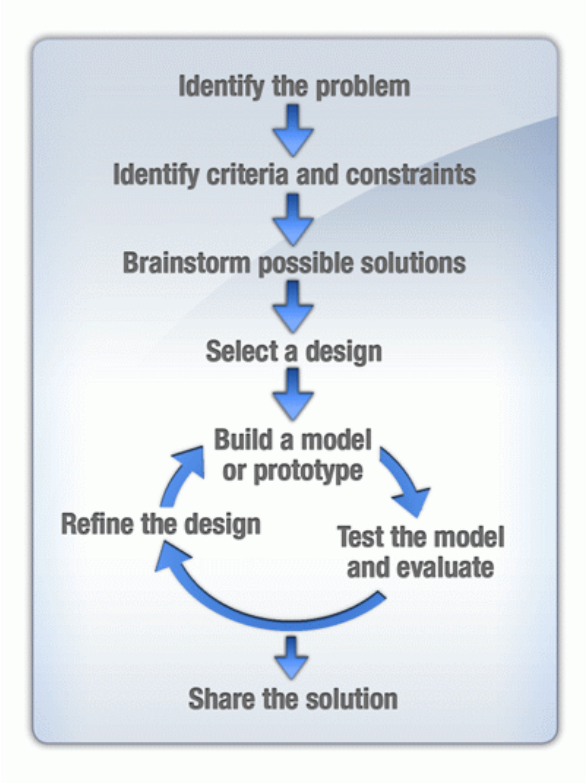
NASA Goddard OPTIMUS PRIME Spinoff Challenge
Engineering Design Process

Task 1: Identify the Problem (4 Steps)

NASA engineers and scientists encounter hundreds of unique design challenges for each NASA mission. To solve these problems, engineers work through the design process.

Step 1: The Problems
For the NASA Goddard OPTIMUS PRIME Spinoff Challenge, your team will learn about NASA technology spinoffs and then use the engineering design process to design your own spinoff innovation from NASA technology.



Step 2: Background Information
Explore the Spinoffs and Resources Tabs for background information. You may want to organize your research and thinking in a project notebook.

Consider recording this information in your notebook:

- What you have learned that may help with the Video Challenge.
- List of other questions you have about the Video Challenge.
- Which NASA spinoff you would like to explore further.

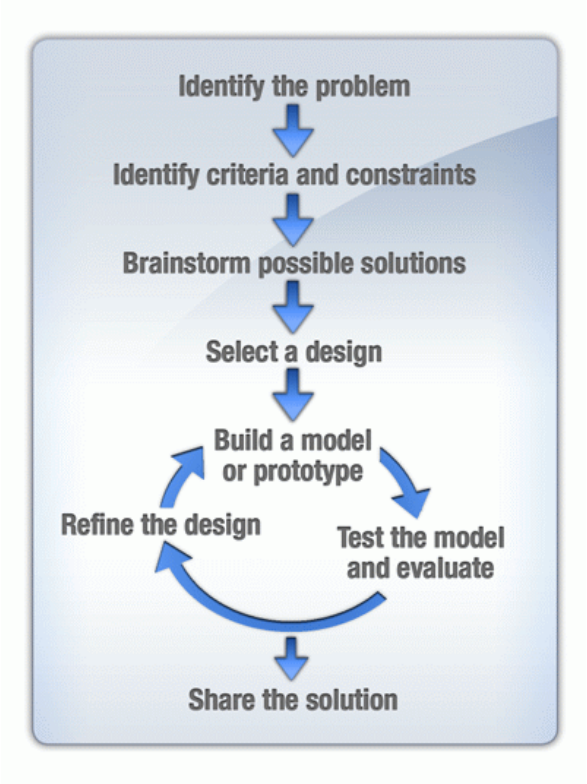
Step 3: Reflection
Respond to the following questions in your project notebook.

1. Which mission and spinoff did you choose? What factors did you consider when making your decision? What are the greatest obstacles you anticipate with designing your own spinoff innovation?

Continue on to Task 2: Identify Criteria and Constraints

Task 2: Identify Criteria and Constraints

Now that you have determined the technology you will explore, it is time to identify the criteria and constraints to consider as you design your own spinoff innovation.



Criteria are specific conditions that must be met to solve the problem.

Constraints are factors that limit a solution.

NASA engineers spend years planning and testing to ensure that their designs and innovations satisfy the mission requirements.

Step 1: Review the Design Criteria

What criteria and constraints should you consider as you design a new spinoff innovation?

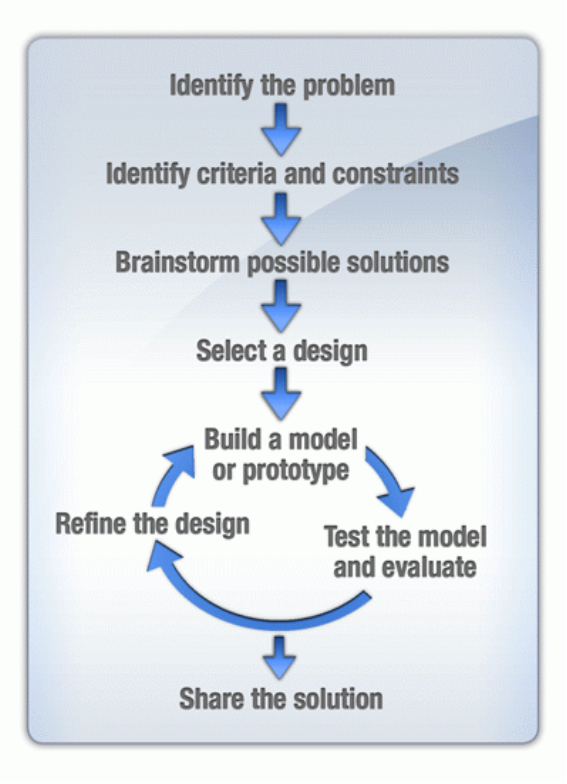
Step 2: Reflection

Respond to these questions in your notebook:

- In your opinion, which criteria will be the most difficult to meet? Why?
- What are some other constraints and criteria to consider? Develop a more complete list of criteria ***BEFORE*** you begin to design your solution.

Continue on to Task 3: Brainstorm and Select Solution

Task 3: Brainstorm and Select a Design



Now that you have a better understanding of the criteria and constraints, brainstorm some possible solutions that fit these criteria and constraints. The brainstorming stage is often the most enjoyable step in the problem-solving process. Be creative! Every idea should be recorded and considered.
Don't judge any ideas … yet.

Step 1: Choose a Design
As a team, eliminate designs that do not satisfy all of the criteria or modify an existing final design so that it meets the requirements. Discuss the pros and cons of each remaining final design until you can come to an agreement and choose one design.

Step 2: Create a Sketch of the Spinoff Innovation
To complete this brainstorming session, create a realistic drawing of the chosen design.

Continue to improve your design concept collaboratively.

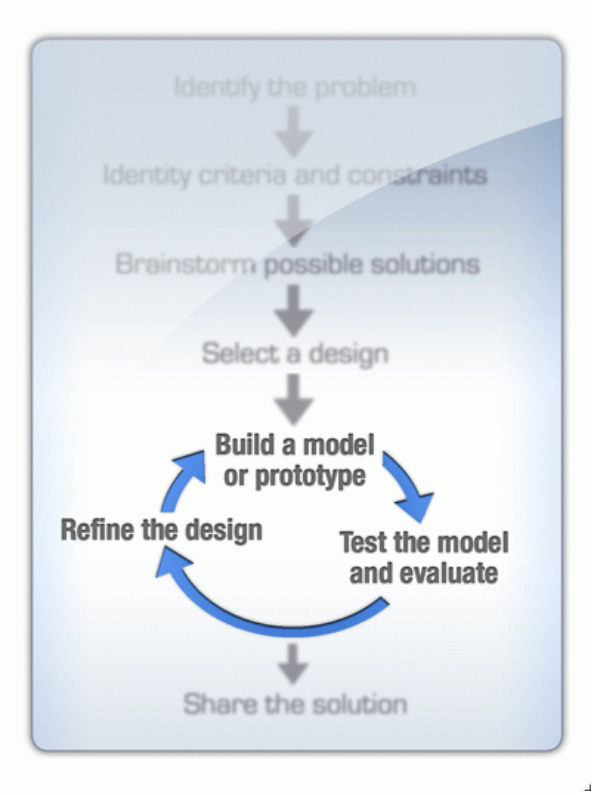
Step 3: Reflection

Respond to these questions in your notebook:

- What makes the design your team has chosen the best? Justify your choice of design by listing the reasons that you selected this design.
- What challenges might you face creating the model of this design?

Continue on to Task 4: Build, Evaluate & Refine the Design

Task 4: Build, Evaluate, and Refine the Design



In this step, your team will build a model or simulation of the chosen design. Building a model or simulation allows you to uncover unforeseen challenges and refine your design.

Reflection

Respond to these questions in your notebook:

- How has your model changed and improved as a result of peer feedback?
- What are the strengths of your final design? (Reflect on at least two strengths.)
- What are the weaknesses of your final design? (Reflect on at least two weaknesses.)

Continue on to Task 5: Final Reflection

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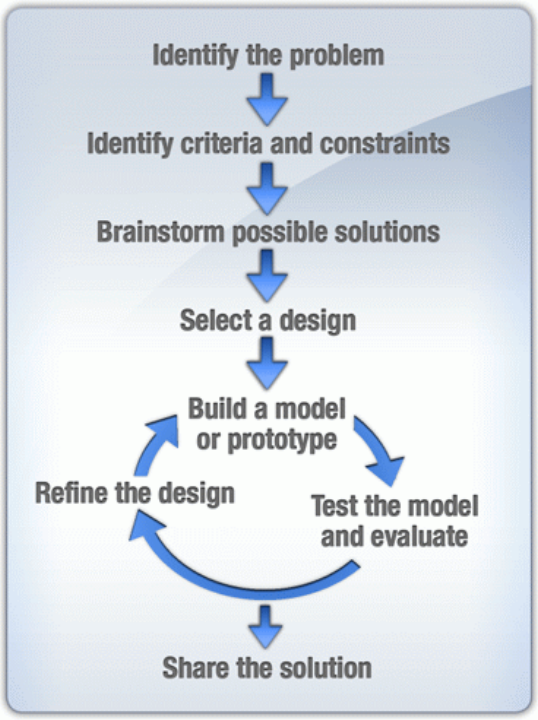

After completing a project like this, it is important to reflect on the work you have done.

Reflect on your work in the design process by responding to these questions in your notebook:

- What was the design challenge and how does your design solve the challenge?
- How did the work that you did through this challenge compare to the work that all engineers and scientists do?
- What role does the engineering design process play in improving technology?
- Describe one time during your work when you learned from failure.
- If you were to begin this challenge again, what would you do differently?
- How have science and technology pushed innovation?

Continue on to Task 6: Share Your Design Solution

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Share your spinoff innovation by completing the OPTIMUS PRIME Spinoff Video Challenge and the OPTIMUS PRIME Spinoff InWorld Challenge.